

CHAPTER 5

Environmental Consequences

Chapter 5 provides information on the methods of analysis applied in the SWEA and the results of analyses for SNL/CA. The chapter begins with an introduction and a summary of the impact assessment methodologies that have been applied. It continues with descriptions of the impacts of the No Action, the Planned Utilization and Operations, and the Maximum Operations Alternatives. For each alternative, impacts are presented by resource area (for example, infrastructure, land use, geology and soils) or topic area (for example, waste generation, transportation, environmental justice).

5.1 INTRODUCTION

Chapter 5 provides an analytical comparison of the environmental impacts associated with the alternatives. Section 5.2 contains a summary discussion of the methodologies used to assess potential impacts. Section 5.3, No Action Alternative; Section 5.4, Planned Utilization and Operations Alternative; and Section 5.5, Maximum Operations Alternative are formatted so that, within each alternative, the discussion is divided into the following resource and topic areas:

- Land Use and Visual Resources
- Geology and Soils
- Water Resources and Hydrology
- Biological Resources
- Cultural Resources
- Air Quality
- Infrastructure
- Transportation
- Waste Generation
- Noise
- Human Health and Worker Safety (including impacts from accidents)
- Socioeconomics
- Environmental Justice

Section 5.6, Accidents, discusses impacts of accidents for all three alternatives. For comparison, environmental emissions and other potential environmental effects are presented with regulatory standards or guidelines, as appropriate. However, for *National Environmental Policy Act 1969* (NEPA) purposes, compliance with regulatory standards is not necessarily an indication of the significance or severity of the environmental impact.

Several resource-specific evaluations have been performed that address the consequences and risks associated with the National Nuclear Security Administration (NNSA) operations at SNL/CA. Each evaluation has a unique scope and purpose. Figure 5-1 illustrates how the facility-based assessments and specific evaluations and consultations flow into the SNL/CA SWEA.

A comparison of impacts among alternatives is presented in Section 5.7. A discussion of cumulative impacts is presented in Chapter 6.

5.2 METHODOLOGY

5.2.1 LAND USE AND VISUAL RESOURCES

A comparative methodology was used to determine impacts to SNL/CA land use. Facility operations and any construction or other modification activities associated with each alternative were compared to the existing conditions. Impacts were identified related to changes in land use classifications, extent of use, alternative or conflicting uses, and accessibility concerns.

The analysis of visual impacts was also comparative and consisted of a qualitative examination of potential changes in visual resources, scenic values (attractiveness), and view corridors (visibility). Aspects of visual modification examined included site development or modification activities that could alter the visibility of SNL/CA structures or obscure views of the surrounding landscape, and changes in land cover that could make structures more visible.

5.2.2 GEOLOGY AND SOILS

Geology and soils analyses encompassed three distinct areas: seismic, slope stability, and soil contamination. The consequences of seismic activity at SNL/CA are addressed within the accident analysis section (5.6).

The slope stability analysis used a map to locate SNL/CA facilities near areas with potentially unstable slopes (at least 10 percent). The 10 percent value was selected as a conservative screening criterion based on the dry site soil conditions and no previous slope stability problems at SNL/CA. For each SNL/CA facility identified, field observations were conducted to support a qualitative evaluation of the effects of SNL/CA activities on these slopes.

The soil contamination analysis considered the potential for human contact of near-surface (the top 6 inches to 1 foot [ft]) contaminated soils and limitations on future land use of these areas. The analysis examined the characteristics of sites where soil contamination could be present (environmental restoration sites). Soil contaminant

concentrations were projected under each alternative and compared with criteria for future designated land use.

5.2.3 WATER RESOURCES AND HYDROLOGY

Water resources and hydrology analyses focused on four distinct areas: groundwater quality, groundwater quantity, surface water quality, and surface water quantity.

The groundwater quality analysis determined to what extent contamination from SNL/CA sites in the unsaturated and saturated zones would limit the potential use of groundwater, particularly as drinking water. Unsaturated zone and groundwater contamination sites that have not been removed, are planned for removal, are final, or are proposed for no further action were characterized in terms of their contaminants, concentrations, and extent.

Groundwater quantity analysis examined future SNL/CA water use projections, evaluating potential impacts of groundwater withdrawal.

The surface water quality analysis examined the potential for future storm water runoff contamination in Arroyo Seco. Arroyo Seco water quality at the point where the arroyo enters the SNL/CA boundary was examined. The analysis examined changes in potential SNL/CA surface water contamination under the three alternatives and the likelihood of these changes affecting regulatory compliance at the downstream exit point of Arroyo Seco.

Effects of SNL/CA facilities on surface water quantity were analyzed based on the incremental contribution of SNL/CA to Arroyo Seco flows from storm water runoff. The current SNL/CA storm water runoff-monitoring program includes visually monitoring 22 discharge locations onsite during storm events and sampling nine locations. The amount of runoff is a function of the permeability of the ground surface or cover material. The percentage of the site's 410-acre drainage to the Arroyo that is impervious (buildings, roads, parking lots, etc.) was estimated for each of the three alternatives.

5.2.4 BIOLOGICAL RESOURCES

Potential impacts are assessed based on the degree to which various habitats or species could be affected by SNL/CA operations. Where possible, impacts are evaluated with respect to Federal and California protection regulations and standards.

Impacts to wildlife and habitat are evaluated in terms of disturbance, displacement, or loss of wildlife. Results of SNL/CA radionuclide monitoring in Livermore Valley released in September 2001 indicated that the average on-site radiation dose was essentially the same as offsite background during calendar year (CY) 2000 (SNL 2001e). The proximity of wetlands to SNL/CA operations was examined. Lists of protected species potentially present at SNL/

Ozone

Ozone (O₃) is a gas composed of three oxygen atoms. It is not usually emitted directly into the air, but at ground level, ozone is created by a chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of heat and sunlight.

VOC + NO_x + Heat + Sunlight = Ozone

Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents are some of the major sources of NO_x and VOC that help to form ozone. Sunlight and hot weather cause ground-level ozone to form in harmful concentrations in the air. As a result, it is known as a summertime air pollutant. Many urban areas tend to have high levels of ground-level ozone, but even rural areas are subject to increased ozone levels because the wind carries ozone and pollutants that form it hundreds of miles away from their original sources.

CA were obtained from the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG). These species lists were used to assess whether SNL/CA operations would affect any plant or animal protected by the *Endangered Species Act* or the *California Endangered Species Act*. In accordance with Section 7 of the *Endangered Species Act*, a biological assessment has been prepared to evaluate the effects of continued operation of SNL/CA on federally listed and candidate species. The biological assessment was submitted to the USFWS on July 19, 2002, and is currently under review by this agency.

5.2.5 CULTURAL RESOURCES

Potential impacts to cultural resources were assessed under the three alternatives. Cultural resources included prehistoric, historic, and Native American resources. Information for impact assessment included previous cultural resource assessments (Busby *et al.*, 1990) and surveys (SNL 2001c, 2001f), and a consultation with the California State Historic Preservation Officer (SHPO). Data on potential SNL/CA activities under the three alternatives were used to estimate impacts to resources (SNL/CA 2002b). Because there are no known resources on the SNL/CA site that are eligible or potentially eligible to the National Register of Historic Places (NRHP), the activities evaluated included only those with the potential to impact undiscovered (buried) archaeological resources.

5.2.6 AIR QUALITY

The methodology used to determine environmental impacts of the proposed alternatives on air quality involves a three-step screening analysis as illustrated in Figure 5-2.

Step 1 performs an initial screening analysis of new or modified projects or proposals, changed circumstances, and new regulations, as described in Chapter 3. The initial screening analysis determines the specific impact areas that may exceed the bounds of the affected environment as described in Section 4.8 Air Quality.

Step 2 analyzed those impact areas that are likely to exceed the air quality ambient background conditions.

Step 3 assessed the air quality to determine the environmental consequences of the increase to the affected area.

The U.S. Environmental Protection Agency (EPA) has established criteria and procedures for demonstrating and assuring conformity of Federal actions to the State Implementation Plans (SIPs) for areas that are designated as nonattainment or maintenance for national ambient air quality standards (NAAQS) for criteria pollutants (40 CFR Parts 6, 51, and 93).

Section 176 (c)(1) of the Clean Air Act (CAA) requires Federal agencies to assure that their actions conform with applicable implementation plans (in most cases the State Implementation Plan) for achieving and maintaining the National Ambient Air Quality Standards for the criteria pollutants, ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, and PM₁₀ (particulate matter with an aerodynamic diameter less than or equal to 10 microns). In 1993, the EPA issued general conformity regulations (40 CFR 51, Subpart W, and 40 CFR 93, Subpart B) that included procedures and criteria for determining whether a proposed Federal action would conform with State implementation plans. In the first phase a conformity review is undertaken to establish whether conformity regulations would apply to a proposed action and alternatives. If such a review determines the proposed actions are in an attainment area, the proposed actions are exempt from conformity requirements, or if in an attainment/maintenance area and the estimated emissions levels for criteria pollutants are less than applicable rates, the proposed actions are also exempt from conformity requirements. The host site for the proposed action at Livermore in the San Francisco Bay Area, is classified as nonattainment (as “Other—equivalent to a moderate nonattainment classification”), as a carbon monoxide maintenance area, and as an attainment area for all criteria pollutants. Hence further review of the proposed actions is required for ozone and carbon monoxide emission estimates from the proposed action from the perspective of the CAA general conformity requirements. Such a review is found in the subsequent subsections 5.3.6, 5.4.6, and 5.5.6 for each of the three alternatives.

The Bay Area Air Quality Management District (BAAQMD), in which SNL/CA is located, is currently in nonattainment for the 1-hour national ozone standard. As required by the *Clean Air Act* (CAA) an Ozone Attainment Plan was submitted to EPA in 1999 to identify a means for the region to attain the national 1-hour ozone standard. This plan was partially disapproved by EPA, requiring revisions that were incorporated into the 2001 Ozone Attainment Plan. When approved by EPA, it will become part of California’s State Implementation Plan (SIP). The 2001 Plan will incorporate into the SIP significant ozone precursor emission reductions designed to enable the region to attain the national 1-hour ozone standard as expeditiously as practicable.

In addition to the existing 1-hour standard, in 1997, EPA published a new national ozone standard-0.08 ppm-averaged over 8 hours (62 FR 38855). In July 2000, based on air monitoring data from 1997 through 1999, the CARB (California Air Resources Board) recommended to EPA a nonattainment designation for the Bay Area for the new 8-hour standard. A plan to attain the 8-hour standard would have been due in 2003. However, a number of issues were litigated in a challenge brought by the American Trucking Association. Certain issues were resolved on appeal to the U.S. Supreme Court, which will probably allow EPA to move forward with setting plan requirements for the 8-hour standard. The schedule for submitting plans for the 8-hour standard has not been set.

In reviewing stationary source measures for possible adoption in the Bay Area, the District employed a *de minimis* standard to ensure the inclusion of measures with potential emission reductions that might help attain the standard while not so minor as to impose administrative burdens that would hinder the effectiveness of the overall effort to adopt measures. The *de minimis* standard is set at 0.1 ton per day. The *de minimis* standard is a level below which the BAAQMD has not proceeded with rule development except to ensure statewide uniformity of local air district rules or for policy reasons unrelated to the efficiency of a measure in reducing ozone. Criteria pollutant emissions from SNL/CA are below the *de minimis* standard and therefore ozone precursor emission reductions are not mandated for SNL/CA (BAAQMD 2001).

The San Francisco Bay Area’s Air Toxics Program integrates Federal and state air toxics mandates with local goals that have been established by the BAAQMD’s Board of Directors. Compounds considered toxic air contaminants that are emitted in excess of minimum trigger levels become subject to the District’s Air Toxics Program. The program consists of several elements that are designed to identify and reduce public exposure to

toxic air contaminants. The three primary control programs are:

- Preconstruction review of new and modified sources
- The Air Toxics “Hot Spots” program
- Air Pollution control measures

The “Hot Spots” program requires facilities to report their air toxics emissions, ascertain health risks, and notify nearby residents of significant risks. Amendments to the “Hot Spots” program further require facilities that pose a significant health risk to the community to reduce their risk through a risk management plan.

5.2.7 INFRASTRUCTURE

Incremental changes to SNL/CA facilities and infrastructure were assessed by comparing the support requirements of the alternatives to current site infrastructure (roads and services) and utility demands (water and electricity) based on projected requirements and available capacities. Impacts were considered to infrastructure, facilities, services, and utilities used by SNL/CA, including infrastructure support provided by Lawrence Livermore National Laboratory (LLNL).

5.2.8 TRANSPORTATION

Transportation impacts were addressed by examining projected onsite and offsite transportation activities involving hazardous materials and wastes (includes radioactive materials and wastes). Regional traffic impacts related to the alternatives also were addressed.

5.2.9 WASTE GENERATION

The waste generation analysis examined impacts associated with potential waste generation activities of SNL/CA, including those for low-level waste (LLW), low-level mixed waste (LLMW), hazardous waste, and process wastewater. Specific facilities or activities that generate waste were evaluated for changes to the five-year (1996-2000) average quantities as a result of the proposed alternatives. SNL/CA waste management facilities capabilities were evaluated for potential impacts to their ability to manage projected waste quantities before transportation to offsite treatment and disposal. The analysis of potential impacts considered physical safety, regulatory requirements, and security measures associated with storage capacity.

Waste quantity projections were a function of individual facilities and projected increases in staffing. The No Action Alternative equaled the five-year average plus the new facilities. The Planned Utilization and Operations Alternative and the Maximum Operations Alternative total (site-wide) waste projections were increased by 13 percent and 53 percent, respectively. Balance of opera-

tion projections were calculated by subtracting facility specific projections from site-wide projections.

5.2.10 NOISE

The methodology used to determine environmental impacts of the proposed alternatives with respect to noise involves a three-step screening analysis as illustrated in Figure 5-3.

Step 1 performed an initial screening analysis of new or modified projects or proposals, changed circumstances, and new regulations, as described in Chapter 3. The initial screening analysis determined the specific impact areas that may exceed the bounds of the affected environment as described in Section 4.12 Noise.

Step 2 analyzed those impact areas that are likely to exceed noise levels defining ambient background conditions.

Step 3 assessed the incremental noise levels to determine the environmental consequences of the increase to the affected area.

The determination as to whether a potential impact is significant with respect to noise is a qualitative assessment of the increase or decrease in noise level experienced by receptors near the source. A subjective response to changes in sound levels based upon judgments of sound present within a short time span indicate that a change of ± 5 decibel, A-weighted sound level (dBA) may be quite noticeable, although changes that take place over a long period of time of this magnitude or greater may be “barely perceptible.” Changes in sound levels of ± 10 dBA within a short time span may be perceived as “dramatic” and changes in sound levels of ± 20 dBA within a short time span may be perceived as “striking.” Dramatic or striking changes in sound level could be considered significant impacts.

5.2.11 HUMAN HEALTH AND WORKER SAFETY

An analysis of environmental conditions related to SNL/CA routine operations under each alternative and the potential radiological and nonradiological health effects to SNL/CA workers and the surrounding public were completed based on a collective dose and work-related illness and injury rates. There are no SNL/CA sources of radioactive air emissions and thus no radiation exposure to the offsite population from SNL/CA operations. The calculations of radiological health effects focus on the collective dose to site workers involved in implementing each alternative. Occupational health impacts are presented as estimated work-related illness and injury rates associated with each of the alternatives.

Radiological doses to the radiation worker population were evaluated using the (average values) historic dosimetry data available for 1998 through 2000. The same approach was used to estimate radiation workers' annual workforce collective dose. The estimated annual workforce collective dose was based on the projected changes in the number of radiation workers under each alternative multiplied by the "average" annual workforce collective dose. Annual workforce collective dose was converted to total number of fatal cancers in the radiation worker population from one year's dose.

Sandia National Laboratories (SNL) nonradiological health impacts to workers were evaluated using occupational illness and injury data, occurrence reports, and industrial hygiene investigation reports available for 1999 through 2001. The SNL/CA illness/injury rate per year under each alternative is expected to remain consistent with the average illness/injury rate calculated for 1997 through 2001. The estimated number of illnesses and injuries per year was based on projected changes in the total number of workers under each alternative multiplied by the "average" illness/injury rate.

5.2.12 SOCIOECONOMICS

The socioeconomic analysis estimated the incremental effects from changes in income and employment associated with the three alternatives at SNL/CA. The socioeconomic ROI, as described in Chapter 4, is the three-county region around SNL/CA, including the city of Livermore, where 89 percent of SNL/CA employees and their families live, spend their wages and salaries, and use their benefits.

Earnings and employment multipliers were used to calculate the incremental effect of changes in socioeconomic conditions at SNL/CA. These multipliers were developed by the U.S. Department of Commerce Economics and Statistics Division of Bureau of Economic Analysis (BEA). The selected socioeconomic impact areas examined:

- Demographics
- Economic base
- Housing and community services

5.2.13 ENVIRONMENTAL JUSTICE

The potential for disproportionately high and adverse human health or environmental impacts from the proposed alternatives on minority and low-income populations was examined in accordance with Executive Order (EO) 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629). Both the *Environmental Justice Guidance Under the National Environmental Policy Act* (CEQ 1997a) and the *Guidance for Incorporating Environ-*

mental Justice Concerns in EPA's NEPA Compliance Analyses (EPA 1998a) provide guidance for identifying minority and low-income populations and determining whether the human health and environmental effects on these populations are disproportionately high and adverse.

The environmental justice analysis presents selected demographics and identifies the locations of minority and low-income populations living in the ROI of a 15-mi radius around SNL/CA (see Section 4.15.2).

5.2.14 ACCIDENT ANALYSIS

DOE guidance for accident analysis allows a graded approach that analyzes accidents at a level of detail that is consistent with the magnitude of the potential impacts (DOE 1993b). The DOE requires that potential hazards be considered if they can lead to accidents that are reasonably foreseeable; that is, there is a mechanism for their occurrence and their probability of occurrence is generally greater than one chance in a million per year. Accidents that are less frequent also may be considered if they could result in high consequences and provide information important to decision-making. Although the impacts of all potential accidents are not required, the accident analysis is required to evaluate a sample of reasonably foreseeable accidents, to demonstrate the range of potential impacts. These accidents would include low frequency, high-consequence and high-frequency, and low-consequence events.

Three general areas of accident analysis were considered in this SWEA: natural phenomenon, material accidents, and operational accidents. The accident impacts described in this section were developed from:

- meetings with facility managers; environment, safety, and health coordinators; and/or safety personnel to identify major potential hazards and identify safety documentation applicable to the SWEA;
- facility visits and tours to identify potential hazardous situations, gain an understanding of the mechanisms that could cause an accident, and obtain information for the development of accident scenarios; and reviews of facility safety documentation, including the SNL/CA Facility and Safety Information Document (SNL/CA 2002a), preliminary hazard screenings (PHSs), NEPA checklists, hazardous material databases, and other source documents prepared by SNL/CA.

The information and data obtained during these activities were used extensively for assessing hazards at SNL/CA facilities, developing accident scenarios, and estimating accident impacts.

Ideally, a complete risk assessment would express the total human health risk as a sum of all potential accident scenarios. Since it is impractical to rigorously quantify

all of the terms in the ideal summation, the purpose of the SWEA accident analysis is to identify a subset of representative accidents and describe the related impacts.

Preliminary screenings of SNL/CA activities and operations were conducted to select facilities and operations to be evaluated. The criteria for screening included types and quantities of hazardous material (includes radioactive and explosives) potential for public concern, and accidents analyzed in other NNSA NEPA documents. This initial screening process resulted in the following list of facilities:

- Combustion Research Facility (CRF) (including the Glass Furnace and Melting Laboratory)
- Building 910
- Building 914
- Building 916
- Building 927
- Integrated Manufacturing Technology Laboratory (IMTL)
- Chemical and Radiation Detection Laboratory (CRDL)
- Area 8 Facilities
- Explosive Storage Area (ESA)
- Hazardous and Radioactive Storage Facilities
- LIGA Technologies Facility (LTF)
- Distributed Information Systems Laboratory (DISL)

All of these facilities are categorized as low-hazard, nonnuclear facilities and generally contain standard industrial hazards. Further screening was performed to eliminate low-hazard activities and operations that would result in small consequences to workers or the public. This further screening eliminated the Distributed Information Systems Laboratory from further consideration, as it would contain no radioactive, chemical, or explosive materials.

Several specific accident scenarios were identified and considered for further analysis. The following were considered natural phenomena accident initiators:

- Earthquake initiated accident
- Lighting initiated accident
- Arroyo Seco flooding
- Grass fire

The following were considered material accident initiators:

- No radiological scenarios are postulated because no sources of potential airborne hazards were identified.

- For the purpose of the chemical hazards assessment, a spectrum of events up to and including the “severe” events that would, from a facility design standpoint, be beyond credible (failure of a U.S. Department of Transportation [DOT]-approved steel cylinder) were considered
- For the purpose of the explosion hazard assessment, six events were considered:
 - Explosion initiated by unspecified event during hydrogen tanker filling operations
 - Explosion initiated by unspecified rupture of hydrogen storage tank
 - Explosion due to operational accidents at the Explosive Destruction System (EDS)
 - Explosion due to operational accidents at the Explosive Storage Area (ESA)
 - Explosion due to operational accidents at magazine explosive storage
 - Oxygen enhanced event due to operational accidents associated with Glass Furnace and Melting Laboratory

The following were considered operational accident initiators:

- Fork lift operation
- Overhead crane operation
- Welding
- Chemical exposures
- Other standard industrial hazards

Two accident scenarios (site-wide earthquake and hydrogen tanker truck explosion) are discussed in detail. The impacts of these accidents are meant to characterize the worse case scenario.

Chemical, oil, or hazardous material spills or releases are possible given the variety of materials handled at SNL/CA. Although substantial quantities of hazardous materials (above threshold levels listed in DOE Order 151.1, “Comprehensive Emergency Management System”) are not present on SNL/CA, some buildings use a variety of chemicals, including cylinders of ammonia, hydrogen cyanide, nitrous oxide, hydrogen sulfide, and carbon monoxide. The Hazardous and Radioactive Storage Facilities stores and handles hazardous and radioactive wastes being prepared for shipment offsite for disposal. These facilities are the onsite receiving point for all chemical wastes and thus have the potential for hazardous spills, releases, or fires. Additionally, most of the onsite research laboratories use small amounts of chemicals for research projects.

No chemical inventories are stored onsite in quantities sufficient to result in hazardous conditions outside the facility boundary or offsite (SNL/CA 2001a).

Illness and injury rates from operations are discussed in the Human Health and Worker Safety section of each alternative.

5.3 NO ACTION ALTERNATIVE

5.3.1 LAND USE AND VISUAL RESOURCES

Implementing the No Action Alternative would not affect the existing land use patterns or visual resources at SNL/CA facilities. Sections 5.3.1.1 and 5.3.1.2 discuss the impact of the No Action Alternative to these resource areas.

5.3.1.1 Land Use

No changes to land use would occur at SNL/CA under the No Action Alternative. The extent of DOE land available for use by SNL/CA, 410 acres, would remain the same. SNL/CA operations would remain consistent with industrial research park uses and would have no foreseeable effects on established land use patterns or requirements. The only changes in the use of specific locations on the site would be using current open spaces to construct new facilities. Construction of the DISL, LTF (Figure 5-4), and Glass Furnace and Melting Laboratory facilities would be consistent with established land use and utilization patterns. Because these facilities would be built within the main campus of the site, filling in empty locations between existing facilities, they would not change the extent of use of the site and accessibility would not be a concern (Figure 5-4). Open areas with paved or landscaped surfaces would remain between these new facilities and existing ones, remaining consistent with the design of the rest of SNL/CA. In addition, the functions of these buildings would be consistent with those surrounding them, thus construction and use of these new facilities would not negate consideration of possible alternative uses of areas adjacent to them.

Under this alternative, the Hazardous and Radioactive Storage Facilities at the site would be modified to increase their efficiency and operability. As these changes would occur to an existing building, there would be no changes or impacts to land use.

5.3.1.2 Visual Resources

The No Action Alternative would not adversely change the overall appearance of the existing landscape, obscure views, increase the visibility of SNL/CA structures, or otherwise detract from the scenic views from SNL/CA or from areas adjacent to the site. New facilities would be placed among existing facilities in areas with common scenic quality. Efforts to incorporate consistent campus-style design would continue and guidance provided by the

Site Visual Quality Guidelines and Landscape Master Plan (Royston *et al.*, 1993) would be followed. The guidance covers building massing, facades, colors, building orientation and entries, traffic circulation corridors, standardized signage, and landscaping. Modifications to the Hazardous and Radioactive Storage Facilities would also follow the guidance, thereby having no impact to visual resources.

5.3.2 GEOLOGY AND SOILS

No impacts to general geology and geologic resources are anticipated. Impacts from geological hazards (seismicity, slope failure) are evaluated below. Risks from contaminated soils are also discussed.

5.3.2.1 Seismology

Strong earthquake ground motion is responsible for producing almost all damaging effects of earthquakes, except for surface-fault rupture. Ground shaking generally causes the most widespread effects, not only because it occurs at considerable distances from the earthquake source, but also because it may trigger secondary effects from ground failure and water inundation. Potential sources for future ground motion at the SNL/CA site include the major regional faults (for example, San Andreas), as well as the local faults including the Greenville, and Las Positas faults (DOE 1992a).

Seismic hazard analyses have been performed for the SNL/CA site. All new buildings and facilities would be built according to established seismic design criteria. Existing facilities continue to be upgraded or replaced to the extent possible (SNL 2001d). Larger earthquakes on more distant faults such as the San Andreas do not significantly affect the hazard estimation for SNL/CA.

5.3.2.2 Slope Stability

At SNL/CA, there is generally little potential for slope instability because the site is situated on gently sloping to nearly flat topography. The exception to this is the extreme southern end of SNL/CA. The hillsides surrounding this area consist of moderately to weakly consolidated sand and gravel, and colluvial and alluvial terrace deposits. The Navy Landfill Site hill has extensive evidence of mass movement (DOE 1992a). There is an increased chance of slope failure during wet years at the dry wash surrounding the Navy Landfill Site. Slope failure at this location would have no effect on SNL/CA facilities.

5.3.2.3 Soils

There could be very minor impacts to the soils due to erosion during construction. Approximately 6 acres of soil would be disturbed because of construction activities associated with building the LTF and DISL facilities. Soil erosion controls (for example, silt fences) would be used to minimize soil erosion.